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COMPOSTS FOR HAWAII



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Compost is the term used to describe partially decomposed or “pre-digested” organic residues. Composting is the process of making composts. This is done before adding the organic materials to the surface of the soil as a mulch or mixing it into the soil as an amendment. Sheet composting is the application of raw organic residues to the surface of the soil and then mixing it in. Strictly speaking, this is the returning of crop residues to the soil and not composting. This discussion will deal with composts and composting. No attempt will be made to distinguish between these two terms.

WHY MAKE COMPOSTS?

Composts are made to use waste organic residues that accumulate around the home. They reduce the volume of these residues by 50 to 75 percent or more, depending upon the type of materials used and the length of time the composting process is carried on. Only those residues that are biodegradable are suitable for composts. Metal, glass, concrete, etc., do not decompose and should not be used.

The physical condition of the organic residues is improved and ease of handling increased by composting. Mixing of the compost into the soil is more easily done and is more uniform than where raw materials are used. The beneficial effect of the organic matter upon the soil is shown more quickly when compost is used. The “predigestion” of the materials provides more intimate contact with soil microorganisms and soil particles, thereby giving faster results in the soil.

Composts conserve available plant nutrients contained in the organic residues. Frequently the decomposing process for green, high nitrogen residues is so rapid that the nitrogen and other available nutrients are lost through leaching before growing plants can use them. Composting will prevent the loss of these soluble nutrients, if too much water is not added to the compost. The soluble nutrients will drain away with excess water from the compost pile.



Fig. 1. Large piles of organic wastes are unsightly; composting reduces the quantity of waste and improves the aesthetic quality of the environment.

Many organic residues contain very little nitrogen and large amounts of carbon (i.e., wide C:N ratio). These materials decompose very slowly in the soil. The soil microorganisms will take available nitrogen from the soil to aid in the decomposition of the residues, thereby causing nitrogen deficiency to the plants growing in the soil. Later, this nitrogen is released for plant use, but growth and yields will have been reduced before this occurs. Composting these materials will prevent such soil deficiencies even on a temporary basis.

Composts are often used to conserve the nutrients contained in animal manures, sewage sludge and similar materials. When these materials are stored in the fresh state, loss of plant nutrients occurs by both volatilization and leaching. Using these materials in compost will conserve these nutrients and aid in the more rapid decomposition of the compost materials. Where dried or "cured" manures are used, such losses have already occurred, although such manures will aid more rapid decomposition of the compost.

Large amounts of organic matter are unsightly. They occupy considerable space and reduce growth of the plants covered by the material. Placing these wastes in a compost pile reduces both the unsightliness and the space occupied by the material (Figure 1).

Two problems often associated with composting are flies and offensive odors. The decomposing residues provide ideal conditions for flies to breed, especially where garbage and manures are used. These same materials often cause offensive odors in the compost pile. Care should be taken that the compost pile is not too wet and is turned often enough to keep it well aerated and odorless.

MATERIALS FOR COMPOSTING

Almost any plant or animal material may be used to produce a compost (Figure 2). Leaves, grass clippings, weeds, peat, seaweed, water hyacinths, garden refuse, kitchen wastes, cow manure, chicken manure, sewage sludge, green legumes, cane trash, bagasse, pineapple trash, straw and spoiled hay are among the excellent materials for this purpose. Other materials, sometimes used but less desirable, are wood chips, woodshavings, sawdust and tree bark. Green succulent materials decompose more rapidly than mature, dry plant residues, due to a higher nitrogen level, a smaller percentage of resistant components, and the presence of more moisture in the green plants.



(A)



(B)

Fig. 2. Most plant and animal materials may be used to make composts. Some examples are (A) bagasse, (B) sewage sludge, (C) wood-chips and leaves, (D) manure, (E) grass clippings and (F) water hyacinths.



(C)

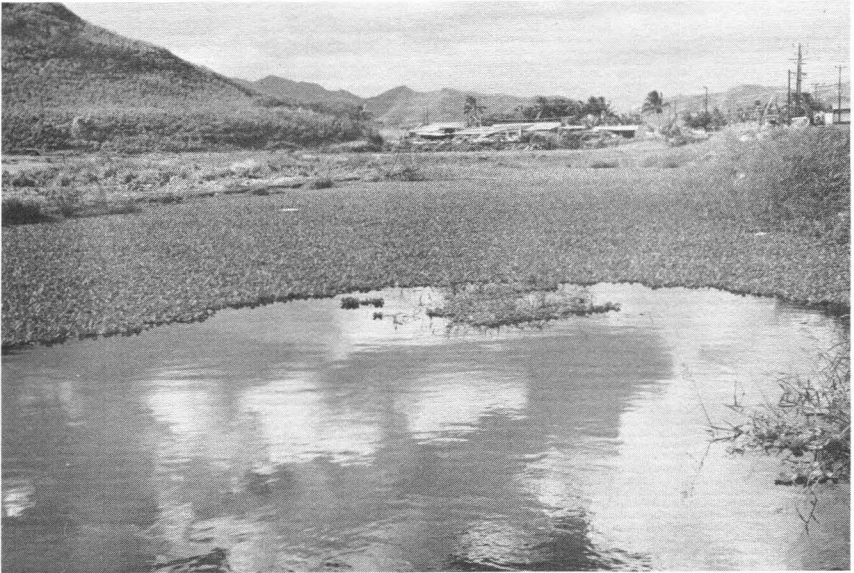


(D)

Fig. 2. Continued.



(E)



(F)

Fig. 2. Continued.

MAKING THE COMPOST PILE

Make the compost pile of convenient size, depending upon the space available and the supply of organic residues for composting. Usually a pile 6 to 8 feet wide and 3 to 5 feet high is most convenient; the length will depend upon the factors mentioned above. The top should be nearly flat with a shallow depression in the center to catch and hold water. The compost may be made in piles, barrels, on platforms, in pits, in boarded-up enclosures, wire enclosures or any enclosure (Figure 3).

If dry materials are used, water must be added to insure proper functioning of the decomposing microorganisms. Add enough water added to wet the materials to the consistency of a squeezed-out sponge. If too much water is used, it will exclude air and delay the process of decomposition. A satisfactory method to follow is to make a layer of material about 1 foot deep, moisten thoroughly with water and pack. Spread a layer of manure or sewage sludge 4 to 6 inches deep over the layer of wet material. A layer of soil 2 to 4 inches deep may be substituted for the manure or placed over the manure. Over this layer, uniformly spread any plant nutrients to be used. Repeat the process, making alternate layers of the organic residues and manure until the compost pile is of the desired height.

A compost made like this will begin to heat in 2 to 3 days (Figure 4). Watch it carefully during this stage and do not allow it to become too wet or too dry. In 3 or 4 weeks, turn and mix the pile (Figure 5) to insure uniform mixing of the residues. In Hawaii, the compost should be ready for use after another 3- or 4-week period. Compost prepared in this manner is an excellent source of nitrogen and also a valuable material for enriching garden crops on any soil, especially beneficial for the sandy soils of Hawaii.

Often the home gardener would like to have compost decompose more rapidly. This may be accomplished by shredding all materials to be made into compost. Shredding machines or a rotary mower provides good results. All materials are uniformly mixed together rather than being placed in layers. The mixture is dampened as the pile accumulates. It should begin to heat in 24 hours. Turn it every 3 days until satisfactorily decomposed, about 2 to 3 weeks. The materials should be shredded to about 1 inch or less in diameter. This exposes greater surface area to action of the decomposing microorganisms and hastens the process. Frequent turning is necessary to insure adequate aeration for efficient functioning of the microorganisms.



(A)



(B)

Fig. 3. Composts are usually made in piles or, (A) in barrels, (B) on raised platforms of wire, wood, etc., (C) in wire "cages," (D) in boarded-up enclosures.



(C)

(D)

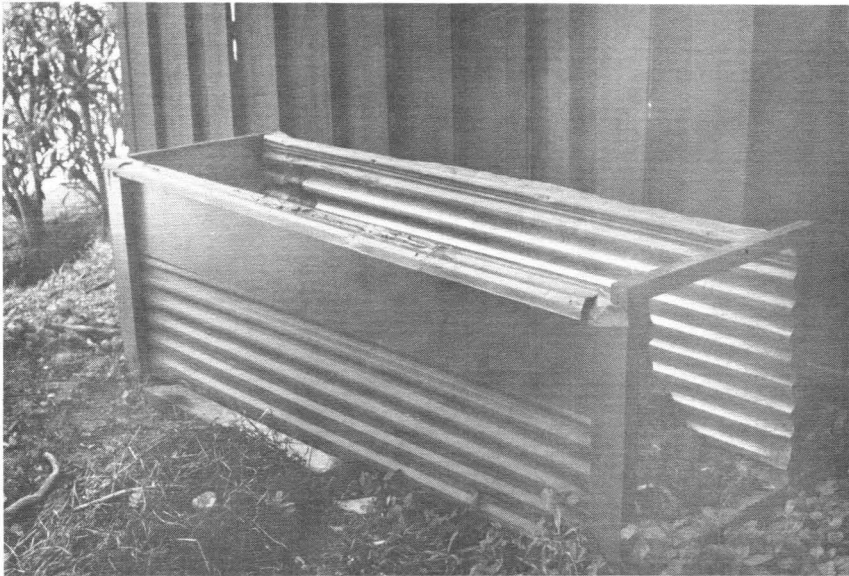


Fig. 3. Continued.



Fig. 4. The compost pile will heat up to 160 to 180 F during the period of decomposition. It should not become too wet or too dry, as this reduces microbiological activity which causes the decomposition and heating of the pile. Note steam rising from the opening in the pile.



Fig. 5. The compost pile should be turned to insure proper mixing of the materials and uniform decomposition of the residues.

In the wet areas of Hawaii, or during periods of heavy rains, it may be necessary to cover the compost pile to prevent it from becoming too wet and losing the soluble plant nutrients in the material.

NUTRIENTS ACCELERATE THE COMPOSTING PROCESS

The microorganisms require adequate supplies of nutrients to function. If these are absent, decomposition will be slow and unsatisfactory. Nitrogen is the most important nutrient, as the microorganisms need large quantities to function properly. If manure is used as suggested above, adequate nitrogen will be supplied. If additional nitrogen is needed, ammonium sulphate¹, sodium nitrate, calcium nitrate, urea, dried blood, cottonseed meal, fish scrap or similar materials may be used. Most organic residues are relatively low in phosphorus. This element may be supplied by use of superphosphate, treble superphosphate, rock phosphate, bone meal or similar materials. Potassium, another element in very low supply in organic residues, may be added by use of muriate of potash, potassium sulfate, wood ashes or similar materials. During the decomposition process, the compost may become quite acid. Ground limestone² is required to neutralize this acidity and provide satisfactory conditions for efficient functioning of the microorganisms. The amount of nutrients required to decompose 1 ton (or 100 cu. ft.) of organic residues to make composts are: 8.4 lb. of nitrogen, 3.0 lb. of available phosphoric acid, 6.2 lb. of water soluble potash and 32.2 lb. of calcium carbonate. If neutral salts of nitrogen and/or wood ashes are used, the calcium carbonate (limestone) is unnecessary.

To determine how much material to use, divide the number of pounds of nutrient needed by the percentage of nutrient in the material. For example: 8.4 lb. of N divided by 21% N in ammonium sulfate would require 40 lb. of ammonium sulfate per ton of residues, or 8.4 lb. of N divided by 6% N in tankage would require 140 lb. of tankage per ton of residues. Similarly, 3.0 lb. of P_2O_5 divided by 47% P_2O_5 in treble superphosphate would require 6.4 lb. of treble superphosphate per ton; or 3.0 lb. divided by 30% P_2O_5 in rock phosphate would require 10 lb. of rock phosphate per ton. Or 6.2% K_2O divided by 62% K_2O in muriate of potash would require 10 lb. of muriate, or 6.2 divided by 10%

¹For composition of plant food carriers, see Hawaii Extension Cir 441, "What's in That Fertilizer Bag?"

²Coral sand or ground coral serves the same purpose.

K_2O in wood ashes would require 62 lb. of wood ashes per ton of residues. Complete fertilizer mixtures, such as 10-20-10, 15-15-15 or similar analyses, may be used instead of the individual carriers as a source of plant nutrients.

COMPOSTS FOR LARGE SCALE OPERATIONS

Composts may be made on a larger scale than that of the home gardener (Figure 6). The piles should be 8 to 10 feet wide, 4 to 6 feet high and as long as desired. Power equipment should be used, where available, to shred-mix and wet the compost. The residues, manures and other materials may be added in the same proportions as described for the home gardener. Materials are added as they become available. They are added to the end of the pile so that the materials that have undergone decomposition for the longest periods may be used first.

Special cultures of microorganisms or activators are unnecessary to hasten decomposition. Manure and soil contain large numbers of microorganisms that will decompose organic residues. These organisms proliferate as the organic sources of energy are added and die back as the organic residues are decomposed.

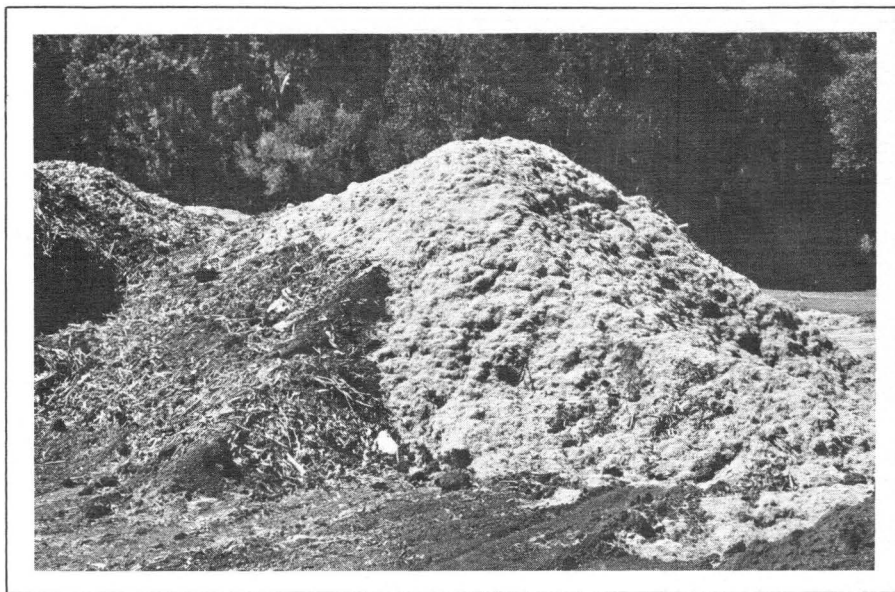


Fig. 6. Composting may be done on large scale basis. Generally raw materials are added at one end and the compost removed from the other.

Composts are artificial manures. The decomposed product is quite uniform in composition and appearance, even though made from a wide variety of materials. It is similar to barnyard manure in composition and effect upon the soil. It is needed in large quantities—8 to 12 tons per acre or more—to provide adequate amounts of nitrogen, phosphorus and potassium for satisfactory growth and yield of garden plants. Plant nutrients from composts are not available until the material is decomposed and the plant nutrients converted into mineral forms that plants use. This is the same form of mineral element as may be supplied from a bag of “chemical” fertilizer. Where readily available sources of plant nutrients are required in early stages of plant growth, supplementary sources of nutrients should be supplied. For example, Manoa lettuce requires large supplies of available nitrogen 2½ to 3 weeks after transplanting. If compost is the only source of nitrogen, growth and yield will be restricted. A side-dressing of an additional quickly available nitrogen source, such as ammonium sulfate, is required to produce such growth. These large amounts of compost are also necessary to provide satisfactory improvement of soil tilth.

Composting is a limited and expensive operation. It requires a large amount of labor and time to properly produce good compost and to thoroughly mix the compost with the soil. However, it provides considerable personal satisfaction as a hobby, as a means of exercise, and as a means of disposing of unsightly, excess, organic wastes.

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